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Socially Contingent Humanoid Robot Head Behaviour Results in Increased Charity Donations

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Abstract—The role of robot social behaviour in changing people’s behaviour is an interesting and yet still open question, with the general assumption that social behaviour is beneficial. In this study, we examine the effect of socially contingent robot behaviours on a charity collection task. Manipulating only behavioural cues (maintaining the same verbal content), we show that when the robot exhibits contingent behaviours consistent with those observable in humans, this results in a 32% increase in money collected over a non-reactive robot. These results suggest that apparent social agency on the part of the robot, even when subtle behavioural cues are used, can result in behavioural change on the part of the interacting human.

Index Terms—Charity; Experimental; Robot behavior design; Quantitative field study

I. INTRODUCTION

Prior work has suggested that highly contingent robot behaviours in complex interaction scenarios leads to an impression of autonomy and life-like attributes [1]. There has been a further suggestion that non-verbal robot behaviours can lead to significantly increased persuasiveness [2], with facial expressions, and particularly gaze, found to be particularly important in human-human interactions [3]. In this contribution we assess the extent to which robot socially-contingent behaviour can alter the behaviour of interacting humans.

The domain of charity collection provides an ideal test-case for such explorations, in part due to the clear means of assessing the difference in contributions per condition (and of course the social contribution made through the money collected). There has been some limited prior work involving charity collecting robots, most notably the iCharibot [4]: in this study involving a wheeled mobile robot with simplified face displayed on a screen, interactivity was found to increase donation amounts over only attracting behaviours and a passive benchmark. The present study differs from, and extends, this prior work in a number of ways. Firstly, we employ a static robot, comprised only of shoulders and head: with a retro-projected face, however, we have the capability to implement a wide range of facial animations, including gaze behaviours (figure 1). Secondly, rather than manipulate interaction content as well as robot behaviour as in [4], we focus only on manipulating the robot’s socially-contingent behaviour. In this way, we seek to assess the specific contribution of the robot behaviour on people’s charity donation behaviour.

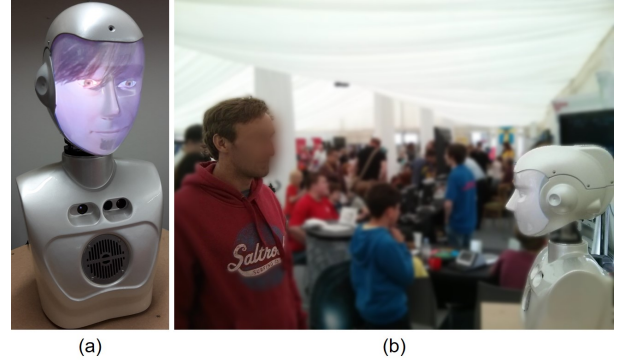


Fig. 1. (a) The robot used in the experiment with a retro-projected face; (b) the robot set up near the entrance of the event space to maximise potential interactions with the public.

The charity chosen was related to support for people with autism spectrum disorders, and their families¹. The content of the robot’s speech was based upon promotional literature from this charity. This content was the same in both experimental conditions, thus ensuring the only difference was the robot behaviour.

II. CHARITY COLLECTION AT A PUBLIC EVENT

A two-condition (contingent vs. non-contingent) study was run to explore the primary hypothesis: a robot that uses socially contingent behaviours will collect more money (for charity) than a robot without these competencies.

The study took place at a public event on a University campus, aimed at public engagement, over two days. The robot was placed adjacent to the main entrance to the event site (figure 1) to maximise potential interaction opportunities with members of the public. An experimenter was present to supervise the robot, but played no role in attracting attention to the robot or in the interactions between the robot and the public.

The robot platform used was a SociBot mini humanoid head on a pan-tilt-roll neck with a range of cameras and RGBD detectors (Engineered Arts Ltd.) and a retro-projected face system [5] which facilitates facial animation responsiveness. The robot was placed on a pedestal so as to appear at head

¹National Autistic Society (UK): <http://www.autism.org.uk/>

height for the average adult. A collection bucket was placed in front of the pedestal; a separate collection bucket was used for each condition. In both conditions a set of scripted speech was used which was triggered at various points during the condition. The script consisted of information on the charity (e.g. why the money was being collected, etc), and verbal encouragement to donate. We reiterate that the speech used was the same in both conditions.

The contingent robot behaviour made use of a range of facial and gaze cues depending on who was in the environment, and how many people there were. For example, the robot would turn to look at people as they came into view, switching gaze if multiple people were present (and making use of short 0.25s glances). This was combined with blinking, eyebrow movement and pupil dilation, and reciprocal smiling if this was detected in the interacting people.

The non-contingent robot behaviour consisted of the robot uttering the scripted speech at predefined intervals, with no movement (either motor or projected), other than the lips (synchronised with the string spoken).

In order to balance exposure of each condition to the public, and given variable attendance through the day, each robot behaviour condition was alternated throughout the day, in 15 minute periods. At the end of each period, the robot would signal the experimenter (using a phrase such as “I feel sleepy”), at which point the experimenter would switch collection buckets. The robot behaviour controller switched automatically. Given the 13 hour experiment length, this meant that each condition was run on 26 separate occasions.

III. RESULTS AND DISCUSSION

The metric with which the primary hypothesis is tested is the amount of money collected in each condition, with a total of £61.41 obtained. The results show that there was a 32.2% increase in monies collected for the contingent condition over the non-contingent condition (figure 2). This therefore suggests that the hypothesis is supported.

This result is consistent with other work: one study demonstrated that the presence of eyes on charity collection buckets increased donation rates over control non-eye images, particularly during quiet periods [6], a result that has been replicated [7]. While in the present study both conditions had eyes, the addition of contingent behaviours (to both eyes and facial features) is suggested to increase the impact of these eyes, by perhaps increasing the sense of social agency, thus increasing the effect. This suggestion is supported by human-human interaction data, which showed that mutual eye contact increased charity donations [8].

Subjectively however, a number of members of the public who engaged with the robot reported that the robot looked “creepy” or “scary”, particularly in the contingent condition, where the robot attempted to make eye contact. This suggests that the mere addition of a human-like competence is not desirable [9], and that further refinement of behaviour is necessary to make it appropriate (e.g. the addition of suitable gaze-aversion strategies).

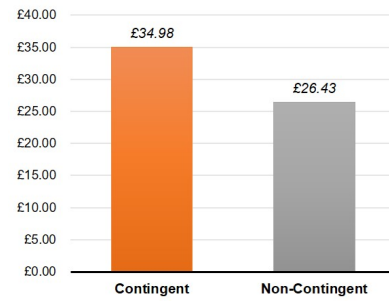


Fig. 2. Comparison of money collected in the two conditions, demonstrating a 32.2% increase for the socially contingent condition over the control.

There are a number of limitations of the study which can be rectified in future experiment replication. For example, one of these is related to data collection. The number of people who donated, and the individual amounts donated, were not recorded (for technical reasons). This makes it difficult to assess the extent of the differences in donation behaviour between the two conditions, apart from the overall donation amount, in a manner similar to prior work [4].

Nevertheless, we have demonstrated here the basis for further investigation into the role of head-based socially contingent behaviours on the donation behaviours of casual passers-by in a public space, as afforded by the retro-projected face. This suggests the positive role that apparent social agency can play on modifying the pro-social behaviour of humans.

ACKNOWLEDGMENT

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